

Tabular Function (TF) Package Users' Guide

The Tabular Function (TF) package allows the user to input one-dimensional tables, specify boundary conditions at the end points of the table and use the tables from any portion of the code.

The Users' Guide gives a description of the TF package input, with some examples.

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1. Introduction

The Tabular Function (TF) package allows the user to define one-dimensional tables of (x,y) data pairs for arbitrary independent and dependent variables and to specify extrapolation conditions at the end points of these tables. These tables may then be accessed from other packages in MELCOR as specified by the user via input to those packages. Common uses of tabular functions in MELCOR include specifying decay heat power, control volume mass/energy sources, and flow path velocities as functions of time; defining material properties as functions of temperature; and specifying heat structure boundary conditions (heat transfer coefficient, heat flux, or surface temperature) as functions of time or temperature. Also, user-defined control functions may access tabular functions to specify functional relationships between arbitrary pairs of variables.

Tabular function tables are defined by entering data pairs for the independent and dependent variables. The value of the tabular function (i.e., the y-value for a given x-value) is generated by linear interpolation between the data pairs. The interpolated value is then multiplied by a factor specified by the user and added to another user-specified constant. The minimum number of data pairs defined by the user is one; the maximum is presently limited to a thousand. (For very large tables, the External Data File package can be used; see the EDF Package Users' Guide.)

In most situations input data pairs are sorted so that the independent variables are monotonically increasing. However, step functions can be included in a table by entering two or more values of the independent variable which are equal. In this case, the values are not automatically sorted and entering a decreasing sequence of the independent variable is treated as a fatal error. If a step function is entered and a value is requested which is exactly equal to the step position, the last value entered is returned.

Three options for extrapolation conditions at the upper and lower boundaries of the table are available:

- (1) The domain of the function can be extended indefinitely with the function value set equal to the value at the boundary and held constant (the default).
- (2) The domain of the function can be extended indefinitely with the two data pairs at the boundary used to linearly extrapolate the table.
- (3) The domain of the function can be limited to that spanned by the data pairs' independent variables. If the independent variable is outside the domain of definition, then a fatal error flag is set, and the value is set equal to the boundary value.

Different options may be applied at each end of a table.

2. MELGEN User Input

The user must input two or more records to define a tabular function. The records and their fields are required unless otherwise stated. The records are:

TFnnn00 – Tabular Function Parameter Record

001 ≤ nnn ≤ 999, nnn is the tabular function number.

Required

This record defines the tabular function name, number of data pairs, additive and multiplicative constant. The number of tabular function pairs entered on this record is compared to the number of pairs read in for this tabular function. If they do not agree, then an error occurs. The value of the tabular function is equal to

$$TFVALU = TFSCAL * f(x) + TFADCN$$

where $f(x)$ is the interpolated value of the data pairs. If TFADCN is not defined on the record, then a default value of zero is used.

- (1) TFNAME - User-specified tabular function name.
(type = character*16, default = none)
- (2) NTFPAR - Number of tabular function data pairs.
(type = integer, default = none, units = none)
- (3) TFSCAL - Multiplicative scale factor.
(type = real, default = none, units = none)
- (4) TFADCN - Additive constant. This field is optional.
(type = real, default = 0, units = none)

TFnnn01 – Boundary Condition Record

001 ≤ nnn ≤ 999, nnn is the tabular function number.

Optional

The tabular function may be extended beyond its endpoints by extending the function indefinitely and holding the value constant at the endpoint, linearly extrapolating the value from the endpoint and the value nearest the endpoint, or returning an error if a value outside the domain of definition is requested. The upper and lower boundary switches may be individually set as follows:

= 0, Extend the domain indefinitely and hold constant at the boundary value (the default).

= 1, Extend the domain indefinitely and linearly extrapolate the two data pairs at the boundary.

= 2, Running off the domain of the tabular function is prohibited.

(1) NTFBDL - Lower boundary condition switch.
(type = integer, default = 0, units = none)

(2) NTFBDU - Upper boundary condition switch.
(type = integer, default = 0, units = none)

TFnnnkk – Data Pairs

$001 \leq nnn \leq 999$, nnn is the tabular function number.

$10 \leq kk \leq 99$, kk is used for ordering the input.

Required

The tabular function is defined by data pairs. The first number in a pair is the independent variable, the second number is the dependent variable. There may be an arbitrary number of pairs on a record, but a pair may not be split across a record.

(1) X - The first element (independent variable) in a data pair.
(type = real, default = none, dimension = none, units = as appropriate for the tabular function data)

(2) Y - The second element (dependent variable) in a data pair.
(type = real, default = none, units = as appropriate for the tabular function data)

3. MELCOR User Input

At present the TF package data cannot be changed in MELCOR user input.

4. Example Input

The following input records define four tabular functions. The first has four data pairs and the second has only one (constant function). The last two are step functions with a control function that could be used with a valve junction to open and close the valve. For more information on control functions, see the CF Package Users' Guide.

```
TF00100   ' Bills function'   4      1.
TF00110   0.    1.    5.    100.5   * first two data pairs
TF00111   100.8    55.           * third data pair
```

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```
TF00120    5000.      90.993      * fourth data pair
*
*
TF10000    'Sams constant function' 1      1.      0.
TF10010    0.      1.
*
* Note the next two functions illustrate two different
* ways of constructing a step function.
* These tabular functions with the control function can be
* used as a valve to control opening and closing.
*
CF20000    'valve control'      HYST 1      1.      0.
CF20001    0.0
CF20003    -201      * open TF
CF20004    -202      * close TF
CF20010    1.0  0.0  cvh-p.210 * look at pressure in cvh volume 210
*
TF20100    'valve open'      2      1.      0.
TF20101    0      0      * this is the default
TF20110    7.07E6      0.      * closed until p increases to 7.07 MPa
TF20111    7.07E6      1.      * full open
*
TF20200    'valve close'      4      1.      0.
TF20201    2      2
TF20210    -1.E20      0.
TF20211    6.7E6      0.      * opened until p decreases to 6.7 MPa
TF20212    6.7E6      1.      * full close
TF20213    1.E20      1.
```